

As the result of my calculations, I can definitely state that the magnetic declination at Greenwich shows no period between 25.5 and 27.5 days having an amplitude as great as 6'' of arc. The influence of solar rotation on magnetic variation may therefore be considered to be definitely disproved.

The intensity of the periodograph increases rapidly with the period, and minute variations are therefore more easily detected in short than in longer periods. Six seconds of arc forms about the limit of amplitude, which can be detected in twenty-five years of observations, when the period is about twenty-six days; and from what has been said above, the amplitude which can be detected will be seen to vary inversely with the square root of the time interval. For periods of about fourteen days, an amplitude of 3'' of arc is still distinguishable with the material I have used; and such an amplitude is actually found for a period which has half the synodic month as its time. The chance that this apparent variation is due to an accidental coincidence is one in two thousand; and I can not therefore assert its definite existence beyond all possibility of cavil. But it is surely significant that of all the periods possible between 12.3 and 13.7 days, that gives the highest amplitude which coincides with half the synodic revolution of the moon. That it is at all possible to detect variations of 3'' of arc in the observations which are taken to 6'', with a probability of error of only one in two thousand, is, I think, a proof of the value of the method and the carefulness of the observations. The periodograph has another valuable use. It not only gives us the time necessary to establish true periodicities of given amplitude, but it also gives us an outside limit for the time beyond which an accumulation of material is of no further advantage. That limit is reached when the time is sufficient to discover the smallest amplitude which the instruments, owing to their imperfections, allow us to detect.

I am only concerned to-day with a purely statistical inquiry, and not with the explanation of any suggested relationship. To prevent misunderstandings, however, I may state that I consider the possibility of a direct magnetic or electric action of the moon excluded; as regards the latter, the diurnal variations of electric potential would be so much affected by a lunar electrification sufficiently strong to influence the outbreak of thunderstorms that it could not have escaped discovery. We must not, however, be dogmatic in asserting the impossibility of indirect action. The unexpected discovery of radio-activity has opened out an entirely new field, and we can not dismiss without renewed careful inquiry the evidence of lunar action which I have given. Its reality can be decided by observation only. No—not by observation only—but by observation supplemented by intelligent discussion; and this brings me to my concluding appeal, which I wish to urge upon you with all the legitimate weight of strong conviction and all the illegitimate influence of presidential infallibility.

The subjects with which our subsection is concerned deal with facts which are revealed to us by observation more frequently than by experiment. There is in consequence a very real danger that the importance of observation misleads us into mistaking the means for the end, as if observation alone could add anything to our knowledge. Observation is like the food supplied to the brain, and knowledge only comes through the digestion of the food. An observation made for its own sake and not for some definite scientific object is a useless observation. Science is not a museum for the storage of disconnected facts and the amusement of the collecting enthusiast. I dislike the name "observatory" for the astronomical workshop, for the same reason that I should dislike my body to be called a food receptacle. Your observing dome would be useless without your computing room and your study. What you want is an astronomical laboratory, a meteorological or magnetic laboratory; attaching to the word "laboratory" its true meaning, which is a workshop in which eyes and hands and brains unite in producing a combined result.

The problems which confront the astronomer being more definite than those of meteorology, astronomy has grown under the stimulus of a healthy tradition. Hence, it is generally recognized, at any rate in the principal observatories, that the advance of knowledge is the chief function of the observer. Nevertheless, the president of the astronomical department of section A last year (Prof. H. H. Turner) has found it neces-

sary, in his admirable address, to warn against the danger there is that the astronomer should allow himself to be swallowed up in a routine work and mere drudgery. The descent is easy: You begin by being a scientific man, you become an observer, then a machine, and finally—if all goes well—you design a new eyepiece.

If such a danger exists in astronomy, what shall we say about meteorology? That science is bred on routine, and drudgery is often its highest ambition. The heavens may fall in, but the wet bulb must be read. Observations are essential, but though you may never be able to observe enough, I think you can observe too much. I do not forget the advances which meteorology has made in recent years, but if you look at these advances, I think you will find that most of them do not depend on the accumulation of a vast quantity of material. The progress in some cases has come through theory, as in the applications of thermodynamics, or through special experiments, as by kite and balloon observations, and when it has come through the ordinary channels of observation, only a comparatively short period of time has been utilized. It would not be a great exaggeration to say that meteorology has advanced in spite of the observations and not because of them.

What can we do to mend matters? If we wish to prepare the way for the gradual substitution of a better system, we should have some one responsible for the continuation of the present one. For this purpose it should be recognized that the head of the meteorological office is something more than a secretary to a board of directors; also that he is appointed to conduct meteorological research and not to sign weather forecasts. The endowment of meteorology should mean a good deal more than the endowment of the telegraph office which transmits the observations.

### WEATHER BUREAU MEN AS INSTRUCTORS IN METEOROLOGY.

According to the published course of studies at Cornell University for the year 1902-3, meteorology is included under geology and physical geography, and two courses are offered to the students by Prof. R. S. Tarr and Section Director R. G. Allen. The course in elementary meteorology occupies two hours a week in the first half year, and the course following this, entitled "Study of Weather Bureau Methods," occupies two hours a week for the whole year. Mr. Allen writes that in the academic year 1900-1901 10 students took the course in elementary meteorology; in the year 1901-2 there were 27; in the current year 1902-3 about one hundred applied but only 48 could be accommodated. In addition to these, two students who have finished the course in elementary meteorology are now taking the course in elementary methods and will take the Weather Bureau examination on October 21.

In the College of Agriculture meteorology appears to find no place, but in the College of Forestry it is one of the courses prescribed for the freshmen year. Doubtless, however, there are some students in the College of Agriculture who take meteorology as an elective study, and one of the seniors in the agricultural course also contemplates taking the Weather Bureau examination.

Mr. W. H. Alexander, Observer, Weather Bureau, reports that on September 18 he delivered an address on the Weather Bureau and the Farmer before the conference of agricultural teachers at Rio Piedras, Porto Rico, W. I. This address was enthusiastically received and was followed by a number of talks by the teachers on cooperation with the Weather Bureau.

W. A. Shaw, Observer, Northfield, Vt., reports that he addressed farmers' institutes in Maine at Perry, August 13, and East Machias, August 14.

### JOHN T. PROBERT.

It will be observed that the intensities are less than they should be on the theory of chance, and it will also be noticed that there is about the same probability or ratio for the periods 25.809 and 26.814. Of course both of these can not be simultaneously correct, so that Schuster's method of discussion has failed to find any period that conforms near enough to Greenwich observations to justify speaking of it as a law of nature. But this failure does not affect the question as to the existence of a true period in the solar phenomena; it simply shows that the Greenwich observations of declination are probably not the proper data upon which to base any such research. As Professor Bigelow's work is based upon the observation of both horizontal and vertical components for many years at stations scattered over the whole globe, his data, therefore, represent actual solar conditions as nearly as these can be determined from terrestrial observations and must give us results of the highest probability. Notwithstanding the expense, it is to be hoped that these original data and laborious computations may be published in full as an important contribution to the study of the relation between the earth and the sun.—Ed.

Another of our oldest voluntary observers has passed away. Mr. John T. Probert, of Paterson, N. J., was born in West Drayton, Middlesex, England, in 1829 of Welsh parentage. When he was 18 years of age his family settled in Paterson, N. J. He learned the trade of a cobbler and developed a large business in the manufacture of shoes. He was an omnivorous reader and his biographer in the Paterson Daily Press states that even at an early age he had acquired a comprehensive library. He was a close student of nature, an ardent lover of geology, and an enthusiastic lover of meteorology.